

Pre-Post Assessment

1. Introduction

School: Ingraham High School, Seattle Public Schools

Grade: 10th grade

Class: pre-IB Chemistry

Unit duration: 2.5 weeks

Description

This unit is an introduction to gases for pre-IB (honors) Chemistry students. Many of these students will be preparing for the IB exam next year and this will be the most time they spend solely focusing on gases prior to that test. The most overarching idea of the unit will be the molecular nature of gases, and how that nature influences their observable behavior. Students will learn the effects that temperature, pressure, and volume have on gases by studying the gas laws. These fundamental laws will then be combined and the ideal gas law introduced to give students the tools to compare all of those variables while taking into account the quantity of gas present. My goals for this unit are for students to recognize and understand gas behavior in their lives and be able to reason through challenging problems by starting with the fundamental nature of gas molecules.

Students will have previously studied chemical formulas, equations, moles, and stoichiometry, so they will be poised to understand reactions involving gases. This will broaden the amount of information we are able to cover, and the complexity of problems students will be able to handle. This unit will also be important for my students because they will be working with conversions between units. This practice will facilitate future science and math coursework, and if well understood, an evaluation of units can help students begin solving problems they might otherwise not know how to start.

Overall, I hope to continue giving my students a solid foundation in chemistry, as my cooperating teacher is currently doing. This unit will teach them about gas behavior, but more importantly will allow them to practice their reasoning abilities and recognize how science explains the world in which they live.

2. Purpose

Assessment is a tool for gathering data to be used by a variety of stakeholders in student education. Depending on the end goal and user, different types of decisions are made based on the results of student assessment. On a classroom level, instructional decisions are made based on the results of assessment (Stiggins, p. 28). Other decisions makers informed by information about student performance are students, program developers, and district/state professionals (Stiggins, p. 29-34). With these criteria in mind, pre-post assessment serves many purposes. It will give my students tangible evidence of their learning over the course of the unit. Such explicit validation of success will motivate students to keep working hard in my class (Stiggins, p. 37). The pre-post assessment will also give important information to the state regarding my “positive impact on student learning” as required for certification. Finally, the pre-post assessment

will give me valuable feedback regarding the success of my teaching strategies. Whether or not my students are reaching the learning targets will highlight to me ways in which I can better my teaching and evaluation of students (Stiggins, p. 31).

In this unit, the pre-assessment will give me insight into students' current understanding of gases. I will be able to adjust my instruction based on misconceptions I uncover with the pre-assessment, or modify the content if there are topics all students understand thoroughly. The pre-assessment will also give the students an idea of the types of topics we will cover, and hopefully motivate them by providing some specific information about the big pictures we will be studying. The post-assessment will provide information to me and my students about their achievement. I will be able to evaluate the effectiveness of my teaching by assessing their attainment of the learning targets. Students will gain a sense of accomplishment from evidence of the effect their efforts had on their learning. From Seattle University's and the State's perspective, results from my pre- and post-assessments will show evidence of my "positive impact on student learning" and allow them to recommend me for certification.

3. Unit-Level Learning Targets

LT-1: Concept. Students will understand that the separate nature of gas molecules causes the observable properties of gases.

EALR 4, 6-8 PS2E Solids, liquids, and gases differ in the motion of individual particles. In solids, particles are packed in a nearly rigid structure; in liquids, particles move around one another; and in gases, particles move almost independently.

LT-2: Concept. Students will understand the relationships between volume and pressure (Boyle's Law), temperature and volume (Charles' Law), and quantity and volume (Avogadro's Law) in ideal gases.

IB Standard 1.4.6 Solve problems involving the relationship between temperature, pressure and volume for a fixed mass of an ideal gas.

IB Standard 1.4.4: Apply Avogadro's law to calculate reacting volumes of gases.

LT-3: Skill (introduced and practiced). Students will be able to solve problems using both the combined gas law, $P_1V_1/T_1 = P_2V_2/T_2$; and the ideal gas law, $PV = nRT$.

EALR 4, 9-11 PS2I: The rate of a physical or chemical change may be affected by factors such as temperature, surface area, and pressure.

IB Standard 1.4.7: Solve problems using the ideal gas equation, $PV = nRT$.

LT-4: Skill (introduced). Students will be able to explain the steps they use in solving problems.

EALR 2, 9-12 INQG: Public communication among scientists is an essential aspect of research. Scientists evaluate the validity of one another's investigations, check the reliability of results, and explain inconsistencies in findings.

4. Assessment Instrument

I plan to use nearly the same assessment instrument (see attached) for both my pre- and post-assessment. This will allow me to directly compare my students' understanding of gases before and after my instruction. Because many of my assessment

questions are multiple choice/selected response, Stiggins says that to evaluate concept level understanding, students must be presented with novel questions they have not had the chance to work out and memorize (p. 102). For this reason, I will change the content of my questions between the pre- and post-assessment. For instance, rather than asking about an increase in temperature, I will ask about a decrease in the same situation. Similarly, with some of the math questions I will change the numbers slightly so that students can show me their ability to work through the problems without already knowing the numerical answers. This will require students to reason through the information while allowing me to assess the same content as the pre-assessment.

In order for my students to reach the concept (LT-1 & 2) and skill-level (LT-3 & 4) unit learning targets, they must have a foundational knowledge of facts. For this reason, I have chosen a combination of selected response and free response questions for my pre and post assessments. This format will allow me to gather evidence about their factual knowledge and reasoning abilities at the beginning of the unit, and their factual knowledge and reasoning abilities at the end of the unit. Stiggins says on page 84 that analytical and comparative reasoning capacities can be measured with selected response assessments. My skill level targets will be assessed through the free-response questions at the end of my assessment instrument. When assessing a skill, the only way to do so is to evaluate students exhibiting the desired behavior (Stiggins, p. 86). Sometimes this is not plausible for every students, and a record of the behavior has to suffice. This is the case with chemistry problems requiring reasoning and calculations. The written evidence of each step the student took en route to the answer serves as a record of their “performance” and will be evaluated as such. This will demonstrate to me student ability to carry out calculations to solve specific types of problems.

5. Possible Mis-measurement

There are several possibilities for ways that my assessment instrument may introduce mis-measurement. I know that simply because much of my assessment instrument is selected response does not mean it is a completely objective measure of student understanding (Stiggins, p. 99). I may have been better off with a different style of assessment instrument, all free response questions for instance. Even with good intentions my questions may target more knowledge based responses rather than the concept level I am aiming for in my unit. If my assessment questions are not closely enough tied to my learning targets I may put students in a position to answer questions about which they have not received adequate instruction. I plan to use the information I gather from the pre-assessment in my curriculum planning, but even if many students answer a certain question correctly, I will still touch on that topic in my instruction. In this way, students who may not have started with as solid a knowledge base will not be penalized in quantity of instruction because their peers know some of the content. This will be a fine balancing act, but I would rather error on the side of over-instruction to make sure all students are exposed to as much content as possible.

Another issue with this assessment may be readability. Depending on the reading level of my students, or their proficiency in English if it is their second language, I may fail to accurately assess their chemistry competence because they cannot understand the language of the test questions. To combat this bias I could edit my assessment instrument

paying special attention to the language I use so that each question is presented in as simple and straight forward of language as possible.